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KNEE

The Oxford phase III unicompartmental knee replacement in patients less than 60 years of age

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Abstract Treatment of younger patients with medial unicompartmental disease of the knee joint remains a challenging therapeutic dilemma. With the refinement of implant design, fixation and the minimally invasive techniques employed with unicompartmental knee replacement, indications have expanded to include its use in young patients. A prospective cohort of 46 unicompartmental knee procedures were performed with a 2-year minimum and 6-year maximum follow-up, using the Oxford phase III unicompartmental knee arthroplasty, in the younger patient group (age 60 or younger). We conclude that the unicompartmental knee arthroplasty is an important option for the treatment of medial compartment disease for patients 60 years or younger. Obesity can cause technical difficulties, increased risk of complications and early failure of this prosthesis.

Keywords Unicompartmental knee arthroplasty · Young adult · Obesity · Osteoarthritis

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Introduction

Younger patients with unicompartmental degenerative knee joint diseases present a challenging therapeutic dilemma. These younger patients ask normally more from their prosthesis as they are more active, and increased wear and loosening of any prosthesis is to be expected [23].

High tibial osteotomy is the alternative treatment for these patients with medial compartmental disease [5]. However, obtaining the ideal valgus position of the knee postoperatively is technically difficult and chances of postoperative complications are greater than after placing unicompartmental prosthesis [25]. Comparative retrospective research shows results of the medial unicompartmental knee replacement to be better than those of the osteotomy [4, 12, 29].

The advantages of unicompartmental knee arthroplasty compared with a high tibial osteotomy include higher rates of initial success and less early complications [11, 12]. Total knee arthroplasty (TKA) following high tibial osteotomy is associated with more problems related to surgical exposure and more technical difficulties compared to a conversion of a unicompartmental knee arthroplasty to a TKA [10]. It should be stated although that both procedures are technically demanding.

The Oxford unicompartmental knee replacement shows survival rates of 94–98% in 10 years [14, 26] with the right patient selection, surgical techniques and implant design [13, 18]. The introduction of minimally invasive techniques in the phase III emphasises smaller skin and capsular incisions, limited quadriceps disruption, decrease in morbidity and decreased rehabilitation time [19, 21, 22]. Minimally invasive unicompartmental

knee arthroplasty as an initial arthroplasty procedure alleviates pain, restores the alignment and improves the function with minimal morbidity, without interfering with future total knee arthroplasties [20]. The unicompartmental knee arthroplasty is being performed with increasing frequency for the younger patient with osteoarthritis [7] with good results [17].

Recent studies suggest that the results of the unicompartmental knee arthroplasty in the younger patient group compare well with the results of TKA in the similar age groups [16, 27].

The purpose of this study is to evaluate the mid-term results of the Oxford phase III unicompartmental knee replacement in patients, age sixty or younger by independent surgeons.

Materials and methods

A total of 46 unicompartmental knee arthroplasty procedures were performed between December 1998 and October 2003, using the Oxford phase III unicompartmental knee arthroplasty, in the young patient group (age 60 or younger). Forty-six unicompartmental knee arthroplasty procedures were performed on 43 patients. Three patients had undergone bilateral surgery in separate sessions. All persons gave their informed consent prior to their inclusion in this prospective study. The youngest patient had secondary unicompartmental osteoarthritis due to osteochondritis dissecans. All the other patients suffered from primary unicompartmental osteoarthritis. A strict patient selection criterion was used in all cases [13].

In the younger patients group 55.6% had a body mass index (BMI) of more than 30. The BMI equals a person's weight in kilograms divided by his or hers height in meters squared and correlates well with total body fat [3].

The 46 medial compartment arthroplasties were performed with minimally invasive technique and under tourniquet control.

The discharge criteria were that their immediate postoperative pain had settled and the operated knee was able to flex to a minimum of 90° with no extension deficit.

The results were prospectively recorded by means of a Historical Record, Operation Record, Knee Society Score (KSS), SF-36 questionnaire and the WOMAC Score. Postoperative data were available for every patient.

For the KSS ratings of excellent (85–100 points) and good (71–84 points) were considered to indicate success.

All patients had at least 2 years of follow-up with a maximum of 6 years. All patients had a weight-bearing antero-posterior and lateral radiograph of their replaced knee with each visit at the follow-up clinic. The radiographs were examined for loosening or radiolucency around the femoral and tibial components and for the presence of osteoarthritis changes in the non-replaced compartment graded according to Ahlback classification [1]. The criterion for imaging was that a radiolucent line less than 2 mm thick indicates no increased risk of loosening of the prosthesis [28].

Results

We performed 46 unicompartmental knee arthroplasties in the young adult group. At review, there were two knees (two patients) revised to a TKA.

The group consisted of 43 patients; 14 men and 29 women (3 patients had undergone bilateral surgery). A total of 26 procedures were performed on the left side and 20 on the right. The mean age at the time of surgery was 56 years (43–60). The mean operation time was 85 min (range 50–190 min). The operations were performed by four different surgeons.

All the wounds healed primarily. No infections were documented in this series.

In the 41 patients with no revision, the average KSS knee score improved from preoperative 42.22 [standard deviation (SD) 24.25] to 90.52 (SD 12.22) at the latest follow-up evaluation and the KSS function score from 60 (SD 16.41) to 89.41 (Std Dev 17.71). Hundred percent of the patients had a good or excellent KSS. The WOMAC pain score improved from 44.44 (SD 15.46) to 76.38 (SD 14.99); the WOMAC function score from 46.41 (SD 14.94) to 73.45 (SD 16.36) and the SF-36 questionnaire showed improvement in role emotional, role physical, physical functioning and bodily pain. The median total range of motion measured 120° (range 0°–120°) before surgery and 125° (range 0°–125°) at latest follow-up.

No femoral or tibial component showed radiological loosening. There were radiolucent lines less than 2 mm thick around six tibial components. One of the patients had minor osteoarthritis changes affecting the lateral compartment, graded as Ahlback 1, without symptoms. Six patients with a 1–2 mm overhang of the tibial component on the medial side were asymptomatic (Fig. 1). Three femoral components showed a malalignment, more than 10° of varus or valgus (Fig. 2).

A separate statistical analysis (t test) comparing the result of the obese (BMI > 30) and de-nonobese

Fig. 1 Malalignment of femoral component

(BMI < 30) patient showed only a significant difference (P value of <0.05) in the extension at the last follow-up. The obese patients group revealed less extension (mean of 2°) at the last follow-up.

The first technical failure occurred in a 53-year-old woman with a BMI of 33. She had clinical and radiological loosening of the tibial component and malalignment of the femoral component. Fluoroscopic evaluation showed restricted gliding of the mobile bearing due to the malalignment. The knee was revised after 11 months to a TKA.

The second technical failure had besides the malalignment of the femoral component also serious perioperative complications. This 44-year-old patient with a BMI of 39 had a popliteal vascular injury and the compartment syndrome of the lower leg, which are rare complications of knee arthroplasties. Decompression of all four compartments of the lower leg was performed about 22 h after the initial operation through a double incision technique and 2 weeks later an arterial bypass with autogenous vein was performed with good results. There is still a slight neurological (n.peroneus) impairment. Two and a half years after surgery, revision to a total knee replacement was required for failure of the prosthesis because of malalignment.

Fig. 2 Example of tibial component overhang

Both revisions to a TKA were straight forward, using the standard primary modular components, without the need for bonegraft. The third patient with the malalignment of the femoral component was a nonobese patient and had no complaints and needed no revision.

Discussion

This is the first reported series of the Oxford unicompartmental knee replacement phase III in younger patients in which only a minimally invasive technique without everting the patella is used. This study showed that younger patients with unicompartmental degenerative knee joint diseases have adequate medium term results with an Oxford phase III unicompartmental knee replacement. This technique shortens the early rehabilitation period significantly without affecting the long-term survivorship of the prosthesis [15, 19]. The results were dependent on the weight of the patients, the two failures had a BMI > 32. We think that the failures represent technical errors that can be avoided.

This study shows comparable clinical results and few more complications as the designer's series of younger patients [17]. One of the two technical failures in our series showed clinical and radiological loosening of the tibial component and malalignment of the femoral component. We are of the opinion that the loosening of the tibial component is due to abnormal mechanics in the knee, caused by malalignment of the femoral component. The gliding movement of the meniscal bearing is restricted, causing abnormal stress on the tibial component. Therefore, this was considered a surgical error due to the limited exposure and the obesity.

In the case of the popliteal vascular injury and the compartment syndrome of the lower leg the aetiology for the increase in intracompartmental pressure was probably the venous tourniquet and positional matters during the surgery. The prolonged operating time due

to the obesity and manipulation for the correct positioning of the femoral component made matters worse. The arterial injury is probably caused by manipulation with extreme varus- and valgus-stress, rotation and hyper flexion, which probably lead to an intimal tear which subsequently clotted off as may be seen following a knee dislocation. Due to the fact that the lesion was 12 cm above the knee we do not suspect that it was traumatized directly.

We have a quite large group of obese (BMI > 30) patients in our study. We found no difference in the activity levels measured with the SF-36 questionnaire (physical functioning and role physical). The comparable results in our study between obese and nonobese patients are as other short- and mid-term studies of the TKA [6, 24]. There are studies that suggest that any degree of obesity has a negative effect on the outcome of TKA [8, 9]. To date there are view studies concerning the outcome of unicompartmental knee arthroplasties in obese patients [2, 27]. It should be kept in mind that the technical difficulties, an increased risk of complications and early failure is associated with obesity as seen in the two revision cases in our series. The minimally invasive mobile-bearing unicompartmental knee arthroplasty is technically demanding and complications occur with placement of this unicompartmental knee device. With this minimally invasive technique, the visual field is restricted.

The overhang of six tibia plateaus may also be considered as a technical failure. All cases are asymptomatic, but only further follow-up can provide information with regard to the importance of this finding. Only one of the patients had minor osteoarthritic changes affecting the lateral compartment without complaints.

We conclude that the age of 60 years or younger does not seem to be a contraindication for this procedure. Obesity can cause technical difficulties, increased risk of complications and early failure of this prosthesis; a BMI of 33 or more is a contraindication for the mobile-bearing unicompartmental knee arthroplasty. When the nonoperative treatment of unicompartmental arthritis in the knee fails in young nonobese patients and the symptoms are obvious, mobile-bearing unicompartmental knee described in our study provides the patients and surgeons a potentially attractive treatment option

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